UNITED STATES DEPARTMENT OF AGRICULTURE

BUREAU OF ENTOMOLOGY

FOREST INSECT INVESTIGATIONS

# LIFE HISTORY OF THE MOUNTAIN PINE BEETLE IN WHITEBARK PINE 1935

By
A. L. Gibson
Assistant Entomologist

Forest Insect Laboratory
Coeur d'Alene, Idaho
Feb. 6, 1936

UNITED STATES DEPARTMENT OF AGRICULTURE

BUREAU OF ENTOMOLOGY AND PLANT QUARANTINE

WASHINGTON, D.C. Forest Insect Laboratory
Coeur d'Alene, Idaho
Feb. 10, 1936

U.S. D-1
RECEIVED
FEB 14 1936
FOREST MANAGEMENT
Ans.

Regional Forester
Missoula
Montana

Attention of Mr. Koch

Dear Sir:

There is enclosed a brief report by A. L. Gibson relative to the life history of the mountain pine beetle in whitebark pine. This title is somewhat misstated, as we feel that the data given in this report are governed more by the higher elevations at which whitebark pine occurs than by the host itself. Mr. Gibson's conclusions are the result of field observations over a period of several years.

Yours very truly,

James C. Evenden
Entomologist

Enclosure

# LIFE HISTORY OF THE MOUNTAIN PINE BEETLE IN WHITEBARK PINE 1935

- - - - - - - - - - - - - - -

## INTRODUCTION

During the survey of the Gallatin National Forest in 1931, a few mountain pine beetle-infested whitebark pine were examined in late October in the high mountains northeast of Hutchins, Montana, and found to contain eggs and small larvae. When the survey of that area was repeated on Sept. 12, 1932, these same trees were again examined and found to still contain some brood varying in development from the mature larval to the new adult stages. Although remote, there is a possibility that the new adults emerged subsequent to the examination made in 1932, but there was little likelihood that the larval stages would transform to new adults and emerge before 1933. If part of the brood did not emerge until 1933, nearly two years would have been required to have completed its life cycle.

## THE STUDY

A study to determine the period of development in whitebark pine was projected in 1933. Trees whose approximate time of attack was known were to be examined at regular intervals until emergence of the brood was complete. The examinations were to be one eighth of a square foot on each of the four sides of the tree and to be made at from three to

five feet above the ground. Data were to include the number of the tree, date examined, location of the side, bark thickness, number of attacks, inches of egg gallery, the number of insects in each stage of development, and the number of parent adult and new adult emergence holes.

The two plots on which the study was initiated were located at 9,400 and 9,600 feet elevation on the steep west-facing slope of Comet Mountain near Elkhorn Hot Springs on the Beaverhead National Forest. Although the plots were located in pure whitebark pine at the upper edge of the timber line, it is known that they were not at the altitudinal limits of the species. Burned stumps and logs of whitebark pine were found to nearly 10,000 feet on this 10,100-foot peak. Also young whitebark pine were making good growth 200 to 300 feet above the highest plot.

Each tree in the plot was numbered and its status recorded. The month in which they were attacked could not be determined for the trees which were infested in 1932, but it is assumed from the less advanced stage of development in early 1933 that the trees on Plot I were attacked later than those on Plot II. When these trees were examined in June of 1933, the trees on Plot I contained 63 percent eggs and 37 percent small larvae, but the total brood was light, probably due to the cold spell of the preceding winter. Trees on Plot II, a short distance away, contained 38 percent small larvae and 62 percent large larvae. The difference

five feet above the ground. Data were to include the number of the tree, date examined, location of the side, bark thickness, number of attacks, inches of egg gallery, the number of insects in each stage of development, and the number of parent adult and new adult emergence holes.

The two plots on which the study was initiated were located at 9,400 and 9,600 feet elevation on the steep west-facing slope of Comet Mountain near Elkhorn Hot Springs on the Beaverhead National Forest. Although the plots were located in pure whitebark pine at the upper edge of the timber line, it is known that they were not at the altitudinal limits of the species. Burned stumps and logs of whitebark pine were found to nearly 10,000 feet on this 10,100-foot peak. Also young whitebark pine were making good growth 200 to 300 feet above the highest plot.

Each tree in the plot was numbered and its status recorded. The month in which they were attacked could not be determined for the trees which were infested in 1932, but it is assumed from the less advanced stage of development in early 1933 that the trees on Plot I were attacked later than those on Plot II. When these trees were examined in June of 1933, the trees on Plot I contained 63 percent eggs and 37 percent small larvae, but the total brood was light, probably due to the cold spell of the preceding winter. Trees on Plot II, a short distance away, contained 38 percent small larvae and 62 percent large larvae. The difference

in development continued during 1933, for in late October the trees in Plot I contained 81 percent small and large larvae, 12 percent new adults, and 7 percent emergence holes, while those on Plot II contained only 11 percent large larvae, 19 percent new adults, but had 72 percent emergence holes. Where emerging beetles are numerous, more than one may use an emergence hole, but as no data are available from which to derive a correction factor, only one insect is considered as having emerged from each hole.

The last examination of the trees on the plots in 1933 was made on October 26th. It is not thought any appreciable development occurred subsequent to that date until the following spring. It is noticeable that in spite of advanced development on Plot II a few larvae (11 percent) were still present, indicating that it would be sometime in 1934 before they emerged. These larvae would then have required the period from at least late in 1932 to early in 1934 to complete their life cycle. It is also likely that the 19 percent new adults present in late October overwintered in these trees and did not emerge until 1934.

The insects in trees on Plot I show even more evidence of requiring in excess of one year to complete their life cycle. Some emergence had occurred (7 percent) and 12 percent new adults were found, but 81 percent were still in the larval stage. The proportion of brood requiring at least part of 1934 to complete development amounted to 81 percent, and the new adults also probably overwintered in the trees.

Plans for 1934 called for examination of these trees early in the

season, but other work prevented it until late in June. At the time of the last examination on Oct. 26, 1933, but few insects were present per square foot of surface. When the examinations were repeated on June 28, 1934, emergence had been light and only 13 new adults were found under 5 square feet of bark in 14 trees. Surprisingly, with one exception, they were found in the trees which showed the most advanced brood development the preceding fall. A few larvae, pupae, and new adults were found at the extreme base of some trees, but these were disregarded owing to the possibility that they might have been breed from a basal "fill-in" in 1933.

Such meager data were considered insufficient evidence on which to base definite conclusions, so it was decided in July 1934 to continue examinations of trees attacked in 1934 employing the same method.

Although definite dates of attack were lacking for them, some trees infested in 1933 had been examined twice during 1934. These examinations on June 29th and August 6th gave the following data:

## STATUS OF MOUNTAIN PINE BEETLE BROOD IN WHITEBARK PINE ATTACKED IN 1933

Data from 1/8 square foot examinations on all four sides of the tree made at 3' to 5' above the ground.

| | Date Examined | | | |
|---|---|---|---|---|
| | 8/29/34 | | 8/6/34 | |
| Total Brood | Number | Percent | Number | Percent |
| Eggs | 33 | 10.7 | - - - | - - - |
| 0-½ Larvae | 167 | 54.4 | 37 | 7.1 |
| ½-1 Larvae | 89 | 29.0 | 117 | 22.5 |
| Pupae | 17 | 5.5 | 161 | 31.0 |
| New Adults | - - | - - | 173 | 33.3 |
| New Adult Emergence holes | 1* | .3 | 31* | 6.0 |
| Sq. Ft. Bark Examined | 1⅛ | (3 Trees) | 3 | (6 Trees) |

* Emergence holes only; no estimate attempted of insects emerging from each hole.

From the preceding data we learn that much of the brood was in advanced stages of development in August and some emergence had started. No examinations were made subsequent to that of August 6th until August 12th of the following year. At that time a few new adults were still present at the base of a number of trees, and one tree had a few new adults in the upper part. Although some insects were found, it is felt that the data secured are again insufficient to conclusively prove that more than one year is required for development of the brood in white-bark pine, but the indications are strong that at least part of the brood

requires more than one year.

At the time of the examinations in 1934 the status of the trees on the plots was again determined. On July 3rd bark beetles were "filling-in" trees lightly attacked the preceding year. On August 6th five trees were being attacked and on two others the attacks were apparently complete. No examinations were made of these trees until August of 1935. The data for the two examinations made during that month and another in late October are given in the succeeding tabulation.

## STATUS OF MOUNTAIN PINE BEETLE BROOD IN WHITEBARK PINE ATTACKED IN 1933

Data from 1/8 square foot examinations on all four sides of the tree made at 3' to 5' above the ground.

### Total Brood

| Date Examined | 8/13/35 | | 8/27/35 | | 10/26/35 | |
|---|---|---|---|---|---|---|
| Date Attacked | July 1934 | July-Aug. 1934 | July 1934 | July-Aug. 1934 | July 1934 | July-Aug. 1935 |
| Eggs | -- | -- | -- | 1 | -- | -- |
| 0-⅓ Larvae | 1 | 7 | -- | 10 | -- | 2 |
| ⅓-1 Larvae | 2 | 9 | 2 | 30 | 3 | 3 |
| Pupae | 6 | 14 | -- | 2 | -- | -- |
| New Adults | 145 | 86 | 35 | 66 | 6 | 23 |
| New Adult Emergence Holes | -- | 11 | 36 | 41 | 36 | 27 |
| Sq. Ft. of Bark Examined | 1 (2 Trees) | 1½ (3 Trees) | 1 (2 Trees) | 1½ (3 trees) | ⅛ (1 tree) | 1½ (3 Trees) |

### Percent of Total Brood in Each Stage

| | | | | | | |
|---|---|---|---|---|---|---|
| Eggs | -- | -- | -- | .7 | -- | -- |
| 0-⅓ Larvae | .6 | 5.5 | -- | 6.7 | -- | 3.6 |
| ⅓-1 Larvae | 1.3 | 7.1 | 2.7 | 20.0 | 6.7 | 5.5 |
| Pupae | 3.9 | 11.0 | -- | 1.3 | -- | -- |
| New Adults | 94.2 | 67.7 | 47.9 | 44.0 | 13.3 | 41.8 |
| New Adult emergence holes | -- | 5.7 | 49.3 | 27.3 | 80.0 | 49.1 |

By inspecting the preceding data we learn that from the trees attacked about mid-July of 1934 no emergence had occurred at the end of 13 months, but an estimated 50 percent had left the trees two weeks later. However, in October, 15½ months after attack, large larvae and new adults were still present, although it is estimated that 80 percent of the brood had emerged.

The trees attacked in late July and early August of 1934 showed even slower development. Only 27 percent had apparently emerged at the end of 13 months and 49 percent at the end of October 1935, about 15 months after attack. As snow was already present on the plots on October 26, 1935, the possibility of emergence prior to spring is negligible. It is believed it will be at least the middle of May before the new adults emerge and then only under the influence of an extremely early season. They are more likely to emerge in June or July. On the basis of the data secured up to the present time from these trees attacked in 1934, a minimum of twelve months is known to be required to complete the life cycle, and about twenty percent of the brood requires at least twenty-two months to complete their development. It is planned to make another examination of this last group of trees early in 1936.

From the data already secured it may be seen that emergence from an infested whitebark pine probably begins about twelve months after attack and extends over a period of at least ten months, most likely occurring whenever weather conditions permit.

## SUMMARY

Although the data secured up to the present time on the period required for the life cycle of the mountain pine beetle in whitebark pine is not absolutely conclusive, the evidence is quite strong that the most rapidly developing portion of the brood of the mountain pine beetle requires twelve months and the slowest at least twenty-two months to complete its life history.

Respectfully submitted,

A. L. Gibson
Assistant Entomologist

Coeur d'Alene, Idaho
Feb. 6, 1936